THE

Malayan Agricultural Journal

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EDITORIAL.

After a lapse of five years *The Malayan Agricultural Journal* makes its reappearance, but for 1947 it will be published quarterly only. It was felt that it was desirable to recommence publication as early as possible, but it was also appreciated that, with the need to initiate afresh the experimental work of the Department of Agriculture, material would not yet be forthcoming as readily as formerly to report the results of research and experimentation.

The Department was fortunate in being able to resume active work through its Field Branch shortly after the liberation of Malaya. The staff of Agricultural Officers in this Branch is almost back to its pre-war strength, and officers have been seconded to Borneo, Sarawak and Brunei to assist those countries in the rehabilitation of their agricultural resources. The Department has suffered the loss of a number of officers who died as prisoners of war, and has also lost the services of several senior officers through retirement. Other officers are still unfit for duty, and the Research Branch has had to meet demands for its assistance with a seriously reduced personnel.

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It is regretted that publication of *The Malayan Agricultural Journal* has been delayed due to the reduced electrical supply available to the Printers.

An article in this issue describes present conditions of the industry at Cameron Highlands and shows that, with ruling high prices and a steady, big demand for vegetables, it has become most profitable and gives an astonishingly high return to the growers. That competition from Java and Sumatra must be expected at a later date is admitted, and the article is primarily concerned with making recommendations for the more economical production of vegetables based on the results of experiments carried out prior to the war in this country. Attention is drawn to the very heavy expense incurred by the Chinese market-gardener in the maintenance of the fertility of his holding by the use of artificial fertilizers and expensive supplies of prawn dust and fish refuse, all of which have to be transported to the Highlands from the plains. The author of the article contends that this expenditure is incurred, not for the provision of the mineral nutrients for the growing crop, but in providing the organic matter necessary for the maintenance of the physical structure and biological activity of the soil.

Observations indicate that with large bulk dressings of compost, of the order of 50 tons per acre per crop, full fertility of the land is retained and the need for artificial fertilizers is reduced with most crops.

The provision of large quantities of green matter for bulk compost dressings is a major problem. The author points out, however, that the market gardener usually has less than ½ acre under vegetables out of a holding of 2 to 3 acres, the remaining land being abandoned to weeds and secondary jungle growth. The proportion of green cover required for composting is 6 acres to 1 acre cash-crop, or roughly the proportion of the uncultivated portion of a holding to the cultivated portion. It is suggested, therefore, that the market-gardener should make use of the remainder of his land to grow green cover and thus save the heavy expenditure on fertilizers. By this means vegetable cultivation on the Highlands could be developed on a much sounder economic basis and so be ready to meet the eventual competition of imported vegetables.

Work in P. O. W. Camps.

Although the article on biochemical work in a P.O.W. camp in Thailand has no connexion with argiculture, we do not think any apology is necessary for reprinting it in this Journal. The author is a member of the Department of Agriculture, Malaya, and the article is an extremely interesting and first-hand account of difficult work accomplished under the most arduous conditions, which cannot fail to be of interest to all readers. We are indebted to the *Pharmaceutical Journal* for permission to reprint this article.

Another article in this issue also deals with conditions in a P.O.W. camp. It is also by an officer of the Department of Agriculture, and describes the methods adopted to compost all available waste matter under hygienic conditions to maintain the fertility of a poor soil under exhaustive cropping of vegetables. The results obtained show unmistakably the value of compost as a means of keeping land in good heart, and bear out the recommendations of the Department of Agriculture over a long period of years.

Original Articles.

VEGETABLE PRODUCTION AT CAMERON HIGHLANDS

BY

B. A. Lowe,

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Cameron Highlands district with its elevation varying between 3,000 and 5,000 feet above sea level has been able to develop an important minor industry in the production of vegetables which cannot be produced commercially in the low country. Commencing with a small output when access to the district was first made possible in 1930, production has steadily increased and, for several years prior to the Japanese occupation, output increased rapidly. From 500 tons in 1938, it doubled in 1939, redoubled in 1940 and reached the considerable total of nearly 4,000 tons in 1941.

The Japanese were not slow in appreciating the potentialities of this vegetable trade, especially in view of their food production drive. A Japanese gardener, with some years of local residence prior to the occupation, returned and assumed a monopoly of the trade. An octroi post was erected on the only access road, and the former vegetable grower exacted a handsome toll on all produce passing his gate. He gave every encouragement to vegetable production, and gardeners cheerfully accepted the chance of selecting the best available land in Forest Reserves, Town Board areas, and on estates abandoned by former owners. An influx of gardeners—some of whom were previously employed in producing tin in the Kinta Valley—resulted. To many, the comparative isolation of the Highland valleys, with a minimum of official interference was an attraction; to others, the possibility of a rapid disappearance into the adjacent forest was desirable; and to all, vegetables offered a valuable source of income and of food.

As a result of this increase in the market-garden population, the pre-war record of annually increased production was maintained. With the exit of the Japanese, the grower found from the first month of our return that his market was better and better. British forces were insistent on supplies of cabbages, leeks, and tomatoes as soon as they found the source of supply, shortly after the re-occupation. There has been little competition from imports from the Netherlands Indies, Hong Kong or Australia, factors of some importance in pre-war days, and there appears to be an increasing demand from the wealthier Asiatic population, and especially the restaurant trade, for temperate climate vegetables.

Prices have therefore been very high and have shown handsome profits. At the time of writing (early November 1946) an average cabbage is worth 80 cents, and 1 acre will produce 20,000 cabbages in three months. It should be added that, under local conditions, failure of a cabbage crop

is rare, and every one produced finds an immediate sale. It is of interest to record that, at the end of 1945, unrooted cabbage sprouts were selling freely at 50-60 cents each, a price which gives an indication of the value of the crop at that time. (It is customary, locally, to grow cabbage from the sprouts which appear after the " heart " has been harvested. Seed is rarely used).

Marketing and transport conditions have been such during the past year, that it is difficult to make any accurate estimate of the annual production for 1946. From such figures as have been obtained, it is believed that the year will have seen a production of something like 8,000 tons, valued at approximately $500 per ton to the grower, giving an astounding total gross income of $4 million to a district of roughly 1,000 acres of vegetable land with a population of 7,000, of whom not more than one-half are engaged in vegetable production as a full-time occupation. In addition, estimating from retail values, a sum at least twice as great, i.e. $8 million, may well have been made by the wholesalers, the transporters, and the retailers at urban markets.

The demand for hill vegetables seems insatiable, and with the probability of a permanently increased European population, there appears every likelihood of an increase rather than a diminution in the importance of this local industry. It is, however, certain that competition from imports will have to be faced, as growers elsewhere overseas will not be slow to invade a market with retail values of £200 per ton for cabbage and other vegetables not in the luxury class.

In order to be in a position to meet such competition, it is desirable that the local gardener should consider the economics of his holding and question methods which are wasteful.

The market gardener in South China has developed methods of husbandry which in his own country are traditional and which have been proved sound by the retention of fertility over many centuries. These methods are based primarily on dressings of fertilizers such as bean cake, excreta, fish waste, and household ash soaked in urine and nightsoil. There is a winter-fallow, and the garden is usually on flat land subject to flooding which leaves a deposit of silt and organic matter. Such traditional methods have been brought to Malaya, where conditions are entirely different from those of South China. In Cameron Highlands the market gardener crops the land the year round, and for his fertilizer he buys fish and prawn waste which his ancestors have used for centuries. Excreta is invariably used. But there is no winter-fallow here, nor does a flood leave a deposit of silt upon the land cultivated the previous year.

Local vegetable holdings, usually 2-3 acres in extent, have less than ½ acre under crop. The balance is abandoned to weeds and secondary jungle. This is a result of the introduction of methods satisfactory in China to entirely different conditions in Malaya. From time to time, the gardener shifts his cultivation and takes in an area which has been fallowed—i.e.

abandoned—for several years. A new holding, freshly acquired from forest, is cultivated in full for several crops; the major part is then abandoned as yields fall, and cultivation is concentrated on a comparatively small portion of the total holding. As the initial fertility of the forest soil declines, increasing reliance is placed on purchased fertilizers until dressings of ½-1 kati of prawn-dust and fish waste are used in the production of a single cabbage. As an acre carries approximately 20,000 cabbages, something between 6 and 12 tons per acre of these fertilizers may be used for a three-months crop. At present prices, the cost of such dressings may be $2,000-$4,000. However great wastage under conditions of high rainfall might be, such expenditure, merely on mineral nutrients removed by the crop, would be absurd. The equivalent amount of nitrogen, applied as sulphate of ammonia instead of fish and prawn refuse, would require dressings as high as 25-50 cwts. per acre.

Therefore it is maintained that the gardener is not merely purchasing the mineral requirements of his crop. He is primarily purchasing the organic matter necessary for the maintenance of the physical structure and biological activity of his soil. For this organic matter he is paying over $300 per ton (less the value of the minerals contained), while he is surrounded by almost limitless perennial vegetable matter which would be an equally effective, or better, source of fertility. This is available for no more than the labour of cutting, handling, and conversion to a form suitable for incorporation in the soil.

Although the pre-war value of fish waste was one-sixth of the present price, this contention was believed to hold good even then. In order to obtain more definite information, simple observation plots were laid down at the Agricultural Station, Cameron Highlands, in 1939 to investigate the effects of bulky organic matter in the form of compost, with and without dressings of inorganic fertilizers. Two areas of land were chosen, one with high initial fertility resulting from several years of heavy dressing with compost, the other exhausted by an overgrown tea nursery. Each area measured 16 ft. x 80 ft. divided into 4 beds 4 ft. wide. These beds were dressed with compost applied for each crop at rates of 25, 50 and 100 tons per acre with one bed receiving no dressing. Across these beds, five strips 16 ft. long were dressed with artificial fertilizers, giving 4 plots 4 ft. x 16 ft. for each dressing as follows:—ammonium sulphate, 900 lbs. per acre; sodium nitrate, 1,200 lbs. per acre; ammonium sulphate 900 lbs. plus superphosphate 900 lbs. per acre; sodium nitrate 1,200 lbs. plus superphosphate 900 lbs. per acre; and one strip without artificial fertilizers. Summaries of the yields of six crops grown on these plots are recorded in Tables I and II. Table I shows results of varying dressings of compost with constant artificials. Table II shows results of the varying dressings of artificials with constant dressings of compost.

Table I.

Total Bed Yields with Different Dressings of Compost and Equal Dressings of Artificials.

Section A. On land with high initial fertility.

Crop.	Compost dressing in tons per acre per crop.			
	0	25	50	100
		Yields in lbs.		
1. Lettuce ..	72.5	125.2	128.9	98.5
2. Cabbage ..	328.4	386.1	403.1	423.3
3. Parsnips ..	79.6	136.7	152.4	173.2
4. Dwarf Beans ..	2.0	10.2	15.5	14.5
5. Lettuce ..	39.5	84.7	161.2	151.4
6. Turnips ..	36.5	53.9	51.1	66.1
Total ..	558.5	796.8	912 2	927.0

Section B. On land with low initial fertility.

Crop.	Compost dressing in tons per acre per crop.			
	0	25	50	100
		Yields in lbs.		
1. Lettuce ..	0	6.4	64.6	150.9
2. Cabbage ..	28.0	196.1	353.4	444.6
3. Parsnips ..	0.5	31.1	130.7	167.2
4. Dwarf Beans ..	0	11.4	35.2	38.7
5. Lettuce ..	0	111.5	140.4	143.4
6. Turnips ..	19.1	124.1	81.4	64.2
Total ..	47.6	480 6	805.7	1,009.0

Each of the above beds measured 4 ft. x 80 ft. or 1/136th acre. The six crops recorded above occupied the land from 13th June, 1939, to 11th August, 1941, and the observations were continued until the Japanese occupation.

Table II.

Total Strip Yields with Different Dressings of Artificials and Equal Dressings of Compost.

Section A. On land with high initial fertility.

Crop.	Fertilizer dressing in lbs. per acre.				
	Nil	Ammonium Sulphate 900	Sodium Nitrate 1,200	Ammonium Sulphate 900 Superphos: 900	Sod: Nit: 1,200 Superphos: 900
	Yields in lbs.				
1. Lettuce ..	105.5	63.7	82.5	81.5	91.9
2. Cabbage ..	163.5	305.2	366.8	351.2	354.2
3. Parsnips ..	110.4	101.6	105.0	99.0	125.4
4. Dwarf Beans ..	10.4	7.5	6.2	9.7	7.7
5. Lettuce ..	62.5	86.9	88.0	92.1	110.4
6. Turnips ..	43.4	36.2	31.7	42.7	67.0
Total ..	495.7	601.1	680.2	676.2	756.6

Section B. On land with low initial fertility.

Crop.	Fertilizer dressing in lbs. per acre.				
	Nil	Ammonium Sulphate 900	Sodium Nitrate 1,200	Ammonium Sulphate 900 Superphos: 900	Sod: Nit: 1,200 Superphos: 900
	Yields in lbs.				
1. Lettuce ..	39.9	21 1	50.1	42.4	68.4
2. Cabbage ..	116.8	172.1	242.1	218.0	271.0
3. Parsnips ..	61.2	59.2	62.0	65.8	84.7
4. Dwarf Beans ..	14.6	13.9	14.1	17.5	25.2
5. Lettuce ..	80.0	63.6	85.5	80.8	84.8
6. Turnips ..	62.4	52.7	50.0	44.6	79.1
Total ..	374.9	382.6	503.8	469.1	613.2..

Each of the above strips measured 16 ft. x 16 ft., or 1/170th acre. The six crops recorded above occupied the land from 13th June, 1939, to 11th August, 1941, and the observations were continued until the Japanese occupation.

Considering first the effect of compost on land in poor heart, no worthwhile crop was obtained without compost even with heavy application of artificials. Four out of the six crops were, in fact, complete failures. With 25-ton dressings of compost, fair crops were obtained, and it was observed that plots receiving artificials were better than those without. The soil, however, did not darken appreciably with each successive crop, nor did the fertility of the land appear to be increasing. With the 50-ton dressing, a high level of fertility appeared to be achieved at the first crop. The 100-ton dressing gave consistently maximum yields but appeared unnecessarily extravagant.

On the land which started in " good heart ", there appeared to be a marked decline in fertility after the second crop, where no compost was applied. The 25-ton dressing kept fertility going fairly well, while 50 tons and over gave high yields.

In examination of the yields shown in the tables, the sixth crop, turnips, should not be regarded as typical. This crop is subject to severe loss through attacks of *Bacillus caratovorus* which results in rot. These attacks are of increasing severity with increased rates of compost dressing. This crop is therefore not typical in its response to manurial treatment.

The deduction is, therefore, that, if approximately 50 tons of compost per acre can be applied to each crop, full fertility of the land is retained. The response of cabbage to increased nitrogen suggests that dressings of inorganic nitrogen to this crop may be more markedly advantageous in the presence of adequate organic matter. The particular response of turnips may also require special consideration.

The cost of production of compost was considered concurrently with the running of the observation plots on its use. As the provision of green matter is locally the major item in the production of compost, plots of bushy leguminous cover-crops (*Tephrosia Vogelii* and *Crotalaria usaramoensis*) were sown and harvested at intervals of 3 months for the 2 years during which the observation plots were under trial. Yields of compost from these semi-cultivated covers were approximately 20 tons per acre per annum, and the cost of production of compost (under the very atypical and expensive system of an Agricultural Station) worked out at about $8 per ton in 1940.

From these yields it appears that 40 tons of compost per acre per crop, or approximately 120 tons per acre per annum, would require about 6 acres of bushy cover crop for production. This is to say the ratio of land under cash-crop to land producing compost is 1: 6. This, in fact, corresponds fairly closely to the proportion of the average holding which at any one time is under cultivation. As stated previously, the normal holding of 2 or 3 acres has less than ½ acre under actual cash-crop.

Under the present system, the gardener expends, at current prices, sums which may approach $4,000 per acre per crop on prawn and fish waste, while he has available the necessary reserve of land on which to grow the vegetable matter required for compost. By employing his wasted, or fallow,

land for this purpose, he would be saving this great expenditure on purchased fertilizer. Comparatively, his compost becomes worth approximately the price of the prawn waste which is at present about $340 per ton. As previously stated, the 1940 cost of growing and making compost under the expensive conditions of an Agricultural Station was about $8 per ton. Or, reverting to a former contention, the gardener is, in effect, purchasing his prawn and fish waste primarily for its value as organic matter necessary for the maintenance of the texture and biological condition of his soil, and is paying a grossly excessive price for what he could himself produce easily and cheaply.

Therefore, as a means towards self-sufficiency and as a valuable step towards efficiently meeting, on economic grounds, the anticipated competition of imported temperate-climate vegetables which is sure to come again, it is suggested that there should be a marked change in traditional Chinese methods as applied to vegetable production in Cameron Highlands. Instead of purchasing at great expense (and cost must always be high because of transport) bulky forms of organic nitrogen, the gardener should devote some of his attention to the growing of vegetable matter on the portion of his holding not actually under vegetables grown for sale, and he should turn this in green on the land under crop, or convert it to compost with the aid of pig-dung according to the specific requirements of the particular crop being grown.

The regular removal of green matter from the portion of the holding not under crop results in gradual diminution of its fertility. Experimental evidence at the Agricultural Station shows two apparently satisfactory methods of meeting this loss. The one is by a movement of the area under cash crop to an area formerly under a cover-crop or rough vegetation, and a sowing of the former cash-crop area to leguminous covers such as *Tephrosia* or *Crotalaria*. These crop heavily on recently cultivated land, and the green matter thus produced can be utilised to enrich the area newly brought under vegetables. This miniature form of shifting cultivation appears satisfactory and is simple in operation where a holding has a sufficiency of suitable level land. The alternative method which has also proved successful is the manuring of the cover crop or other vegetation with economically small dressings of pig-dung and phosphates, and the permanent retention of the cash-crop area as such. This system is suited to holdings which have a considerable area of steep land and only limited ground level enough for vegetable cultivation without risk of erosion. Such holdings are locally in the majority.

In putting forward these suggestions it is assumed that the majority of permanent vegetable-gardeners keep pigs, the natural and general complement to the production of vegetables. With a few pigs on the holding, the production of compost is greatly facilitated, and the possibility of any serious depletion of mineral matter is minimized, provided a reasonable

balance is maintained between the number of pigs kept and the size of the holding.

It should perhaps be added that at the Agricultural Station some of the heaviest crops and the best in quality in the district are continually produced. Apart from very small quantities of rock phosphates used on a few beds for specific crops, no purchased fertilizers have been used since the re-occupation, nor does there appear any need for them in the presence of the Station's herd of pigs.

Summary.

1. A general review of the production of temperate-climate vegetables in Cameron Highlands is given.
2. A criticism of traditional Chinese methods of vegetable growing, as brought into a totally different environment, is made.
3. Results of observation plots of vegetables treated with compost, with various dressings of inorganic fertilizers, and without, are summarized.
4. It is suggested that the traditional methods, as imported to a different environment, are uneconomic, and that experimental evidence suggests that it would be profitable for vegetable gardeners in this district to devote the major portion of their holdings to the production of vegetable matter for use as fertilizer, either composted or possibly as green manure.
5. Such a change of method is advocated on economic grounds in view of the probability of competition with imports.

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A BRIEF REVIEW OF ESSENTIAL FOODCROP CULTIVATION IN MALAYA

BY

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Such intensive efforts have been directed to the " Grow More Food " campaign and so much has been written in the local press on Malaya's food supplies, that it is desirable in this first issue of *The Malayan Agricultural Journal* since the liberation to give a brief review of the situation.

Rice.—Prior to the war Malaya produced slightly more than one third of her total rice requirements. In 1940 locally grown rice amounted to 335,000 tons, or 35 per cent. of that year's consumption. Complete figures for 1941 are not available, but the total area under padi in the 1940-41 season was 820,480 acres, of which 77,880 acres were under dry padi, giving a yield of 324,000 tons of rice.

Table I shows areas planted with wet and dry padi in the 1945-46 season together with yields. It will be seen that while the planted area of 789,640 acres had fallen by less than 4 per cent., the yield of rice, 225,000 tons, showed a decrease of nearly 31 per cent. Several factors were responsible for this reduced yield. Planting was carried out just before and after the liberation with the result that the same adherance to planting dates would not be observed as in former years. Irrigation systems had suffered serious neglect during the period of the occupation so that padi growing on land with a water supply provided normally by such systems made poor growth due to lack of adequate water. Before the war, high-yielding strains of padi, the result of long years of research work by the Department of Agriculture were used for seed, particular varieties being grown in those parts of the country for which they had been found most suitable. During the occupation the results of this work were largely lost; the Japanese were more interested in their efforts to introduce their own varieties of padi than in the maintenance of established pure strains. They wished to show that they could achieve in one season better results than years of patient experimentation had contrived to do. A considerable loss of high-yielding padi seed resulted, pure strains were mixed and lower yields have been harvested. In addition, the Japanese introduction, Taiwan padi which failed to yield two satisfactory crops per year, brought with it Padi Blast which is a very serious disease in other padi growing countries. By eliminating the planting of the Japanese variety it would seem, from reports on the present crop, that the disease has successfully been brought under control, and little damage from it is expected. Another important factor affecting the crop harvested was the serious depredations by wild pig,

Table I.

Area of Land Planted in Malaya and Yields of Padi. Season 1945-1946.

State	WET			DRY			TOTAL	
	Acres	Gantangs	Average	Acres	Gantangs	Average	Acres	Gantangs
Perak ..	100,730	18,099,000	180	33,550	2,140,000	64	134,280	20,239,000
Selangor ..	33,720	7,569,800	224	4,790	336,300	70	38,510	7,906,100
Negri Sembilan ..	27,691	3,105,550	112	951	34,650	36	28,642	3,140,200
Pahang ..	42,740	5,739,000	134	5,130	311,500	61	47,870	6,050,500
Province Wellesley & Penang ..	36,489	8,063,794	221	—	—	—	36,489	8,063,794
Malacca ..	30,602	4,984,320	163	—	—	—	30,602	4,984,320
Johore ..	16,290	1,133,825	70	14,196	376,080	26	30,486	1,509,905
Kedah ..	213,830	62,954,000	294	5,317	345,000	65	219,147	63,299,000
Kelantan ..	119,531	19,897,051	166	29,777	2,040,080	68	149,308	21,937,131
Perlis ..	35,707	7,532,498	211	204	16,488	81	35,911	7,548,986
Trengganu ..	26,675	4,224,200	158	11,720	976,500	83	38,395	5,200,700
Total ..	684,005	143,303,038	210	105,635	6,576,598	62	789,640	149,879,636

149,879,636 gantangs of padi = 225,044 tons of rice (Conversion 666 gantangs padi = 1 ton rice).

squirrels and rats, pests which had increased enormously during the years of occupation. An intensive rat campaign has already reduced the damage caused by this pest to modest proportions, but such control measures did not have their full effect during the 1945-46 season.

The present season offers a better picture. At the time of writing this review, planting has not yet been completed throughout the country, but it can safely be estimated that the total area of padi will be approximately 837,000 acres, of which approximately 100,000 acres will be dry padi. It is still too early to give an accurate forecast of the crop that can be expected, but careful consideration of past yields suggests that a conservative estimate would be of the order of 275,000 tons, while it is quite possible that this figure may be exceeded. The severe drought at the commencement of the season inevitably had its effect on the newly planted nurseries and early transplanted seedlings, but padi planters throughout the Peninsula made valiant efforts to offset this initial setback.

Essential Foodcrops.—Table II provides a comparison between areas under essential foodcrops at the end of 1940, at the end of 1945, and at 30th June and 30th September 1946. Figures for December, 1946, are not yet available.

This table shows that the total area of foodcrops at the end of the 3rd quarter, 1946, was approximately 272,000 acres as compared with 215,700 acres at the end of 1940.

It will be seen that acreages at the end of 1945 were very high, due to the extensive planting of tapioca and sweet potato during the occupation. It is possible, however, that these figures may not be accurate. There was a tendency to show increased planting during the occupation, and during the first months after the liberation it was not possible to ensure that all such records were verified. Since the end of 1945 there has been substantial harvesting of tapioca, sweet potato, maize and ragi, without comparable replanting, bringing about a big reduction in the areas under these crops, although they show an increase over the 1940 figures. It must be remembered, also, that during the Japanese occupation there was a considerable exodus from the towns into the country; jungle was cleared and new foodcrop areas were developed under compulsion. With the return of the British, people flowed back into the towns, and newly-cleared areas, after having been cropped, were abandoned. Thus inevitably a reduction in foodcrop acreages occurred with the return of more profitable employment in the towns and the cessation of cultivation under compulsion.

Other factors affecting foodcrop cultivation to a considerable extent are: (a) the revival of the rubber industry, resulting in the small-holder transferring his attention to the more profitable tapping of his rubber trees, (b) padi cultivation leaving less time for work on other crops and also taking up padi land which had been planted with foodcrops during the off-season, and (c) the serious damage caused by wild pig. It is inevitable that the small farmer seeing his crops destroyed by pig is unwilling to

Table II.

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Comparative Table of Areas under Essential Foodcrop Cultivation.

Crop	1940 31st Dec.	1945 31st Dec.	1946		
			30th June	30th Sept.	Estate Cultivation
	acres	acres	acres	acres	acres
Tapioca ..	46,292	157,100	83,211	73,589	4,308
Sweet Potato ..	12,366	78,318	35,775	28,007	827
Sago ..	6,976	6,813	6,273	6,283	—
Sugar Cane ..	3,251	10,140	10,370	10,345	—
Groundnuts ..	2,054	5,166	4,131	3,388	96
Maize ..	8,369	17,968	6,130	5,496	2,357
Yams ..	1,859	3,252	2,009	2,008	5
Colocasia ..	2,938	10,800	6,108	5,538	—
Ragi ..	181	23,410	2,956	1,553	1,319
Soya Beans ..	188	652	678	480	—
Pulses ..	—	—	1,208	968	131
Market Gardens (Vegetables) ..	25,406	35,619	21,141	19,397	3,454
Pineapples ..	60,157	25,609	11,705	11,481	—
Bananas ..	45,728	83,352	73,552	71,029	150
Mixed Crops ..	—	—	—	50	4,308
Pumpkins ..	—	—	89	—	—
					15,269*
Total ..	215,765	458,199	265,336	239,612	32,224

* Details not available.

Table III.

Estate Production of Palm Oil and Kernels, May to December, 1946.

STATE	PALM OIL			KERNELS		
	December	Total May to December	Total for year	December	Total August to December	Total for year
Perak ..	896.9	4,663.5	4,663.5	115.6	215.5	215.5
Selangor ..	329.6	1,386.8	1,386.8	21.5	44.2	44.2
N. Sembilan ..	24.0	177.5	177.5	—	—	—
Pahang ..	55.2	207.1	207.1	—	—	—
Johore ..	1,244.6	5,321.5	5,321.5	245.2	671.9	671.9
Kelantan ..	—	—	—	—	—	—
Total ..	2,550.3	11,756.4	11,756.4	382.3	931.6	931.6
1940 ..	3,918.3	41,754.4	57,972.1	565.6	3,540.9	9,611.2
1939 ..	5,195.6	39,336.6	57,372.7	946.8	4,830.4	10,172.4

Note:—In December 31 estates (planted acreage 69,380.2 acres) were in production out of a total of 46 oil palm estates (planted acreage 77,457.9 acres).

continue their cultivation and risk further loss. Continuous efforts have been made since the end of 1945 to obtain adequate supplies of shot guns and ammunition, but only limited quantities of ammunition have been received. Nevertheless, in spite of all these adverse factors and difficulties substantial areas of land are maintained under foodcrop cultivation, and acreages under tapioca, sweet potato, colocasia, sugar-cane, ragi and banana show a satisfactory increase over the 1940 figures.

The big reduction in the area under pineapple is due to the loss of the large acreage in Johore which formerly supplied fruit for the important pineapple canning industry of Malaya. These areas were neglected during the Japanese occupation; fruits were harvested and the land allowed to revert to secondary jungle growth. New areas have already been opened up and planted, but some considerable time must elapse before the large pre-war acreages are reached.

By a Proclamation in 1946 all estates were required to plant a minimum of 2 per cent. of their acreage with foodcrops. Complete returns are not yet available but from Table II it will be seen that at the end of the 3rd quarter, 1946, the total area of such cultivation was over 32,000 acres, representing a valuable addition to Malaya's food resources.

Oil Palm.—Palm oil production, being primarily for export, does not properly come within the scope of this review, but it is felt that the following particulars of the present position will be of general interest.

Table III shows production of palm oil and kernels since May, 1946, together with comparative figures for 1939 and 1940. Factories suffered serious loss of machinery as a result of the invasion but rapid progress has been made in most cases with rehabilitation, and 31 estates, representing approximately 69,000 acres, are now in production, as compared with 46 estates with a total of over 78,000 acres in 1941.

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INTENSIVE GARDENING IN A P.O.W. CAMP

BY

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The Need for Green Vegetables.

As the rations of the prisoners of war slowly and steadily deteriorated, the need for growing additional vegetables to supplement the meagre rations became increasingly obvious, and it was not long before small garden plots were being cultivated by a few individual enthusiasts on behalf of the units to which they belonged.

Frequent changes of quarters, indifference and lack of support, successive alterations in camp boundaries, the arrival and departure of fresh drafts, the general feeling of unsettlement arising from unquenchable optimism, and, in general, a lack of knowledge of the requirements of tropical gardening and a lack of appreciation of the deficiences of a diet based on polished rice, were the principal factors which operated against the full success of these early efforts.

A wide range of products was cultivated. Many, yielding inadequate crops, though providing pleasant adjuncts to an unattractive diet, were most generally grown, and the supreme importance of concentrating on the high vitamin-bearing green-leaf vegetables was appreciated only by the few. Instead, tasty calorie-yielding tubers such as artichokes and sweet potatoes, watery gourds such as cucumbers and pumpkins, attractive foods such as tomatoes and ladies' fingers, and the more difficult crops, maize and groundnuts, herbs and spices, were mostly grown.

Only the more knowledgeable and long-sighted, in those early days, appreciated the urgent need for leaf vegetables such as spinah, *Basella rubra*, amaranth, *Amaranthus gangeticus*, and kangkong, *Ipomoea reptans*, and the leaves of tapioca and sweet potato and of the privet-like shrub "chekur manis", *Sauropus androgynus*. While these are of little use in supplying calories, they are rich in essential vitamins, particularly those belonging to the vitamin B complex.

The situation steadily deteriorated and culminated in serious outbreaks of beri-beri and riboflavinosis, characterized by sore mouths, intestinal disturbances, and severe scrotal dermatitis. Finally the Camp Adminstration decided to appoint a dietician to calculate and adjust the rations so as to provide a properly balanced diet. This task was allotted to Major J. Burgess, F.M.S.V.F., a member of the Malayan Medical Service, and at the same time, Captain A. de K. Frampton, S.S.V.F., of the Department of Agriculture, was placed in charge of camp gardens.

So long as supplies were available, the host of diseases covered by the term 'avitaminosis' was thereafter kept under partial control by vegetables produced in the gardens, and the bulk purchase of groundnuts, tauge (sprouted beans), soya beans, and rice polishings from outside, but, by the end of 1943, these commodities were no longer available and a further severe outbreak of deficiency diseases once more occurred.

The production of leaf vegetables was accordingly stepped up, and the Camp Administration issued a general order for every scrap of land within the encircling wire to be cultivated under unit arrangements. Subsequently the need for producing calorie-bearing foods became of almost equal importance, as food supplies from outside continued to diminish.

By September, 1944, the original ration of 50 gm. leaf vegetables per man per day had been raised to 180 gm. and a peak of 300 gm. was finally reached in November. Thereafter, production remained at about this figure for the remaining period of imprisonment.

The new outbreak of disease, which started in May, 1944, continued until October, when, as a result of the extra intake of green vegetables, there was a sudden decrease in the number of fresh cases, and thereafter these deficiency diseases ceased to be of major importance as a cause of ill-health.

The Fly Menace.

During 1944-45, the prisoners, in numbers varying between four and twelve thousands, were closely concentrated inside and around the walls of Changi gaol, and there was not very much land available for cultivation. The soil, too, was so very poor that the order to cultivate would have been quite ineffective without the application of some form of manure. The gardeners, in desperation, were quite prepared to dig-in human excreta, poultry droppings, raw kitchen waste, and lalang *Imperata arundinacea* (a coarse tall grass), and in fact did so. The Camp Hygiene Officer, Major C. Gunther, A.I.F., naturally objected, and a compromise was reached by the appointment of a Camp Compost Officer, whose first duty was the prevention of unhygienic practices, and whose second duty was to organize the production of compost at various centres under controlled conditions.

It is well known that flies are attracted by rotting material and lay their eggs the moment they alight. Furthermore, the sub-soil provides a perfect medium for fly-breeding, so that, when infected waste is buried, the eggs hatch out; there is ample food and it is cool, dark and moist, and the resulting larvae can move freely up through the loose earth to the surface to pupate and take to flight.

The danger of allowing flies to breed in this way could not be too strongly emphasised in view of the congested conditions, the large number of dysentry carriers, the ever-present risk of cholera, and the low state of health of everybody in the camp.

The Production of Compost Without Flies.

The soils round the gaol ranged from fine loose sand to a yellow lateritic loam with underlying clay. They appeared to have been subjected to soil erosion as they were devoid of humus and appeared to be quite infertile. The sandy soils were too dry, and the loams too hard and compact, to allow the free growth of roots. The problem was to provide sufficient soil nutrients, to improve the soil texture, and to increase its moisture-carrying capacity. There was only one answer: compost must be produced without flies.

To achieve this it was necessary to exercise the strictest supervision over the camp kitchens and poultry runs, and to make certain departures from normal practice in composting. The poultry runs were brushed out and inspected every day; sour food was disposed of down a lidded borehole; and poultry droppings and run sweepings were carefully collected in lidded bins. Similarly, at the kitchens there was scrupulous cleanliness, and the kitchen waste was sorted into covered bins labelled "Rice", "Ashes", "Rubbish", "Wet Waste", "Dry Waste", and "Tea Leaves." The various bins were collected twice daily and delivered to the compost centres, and there disposed of without delay.

At the compost depots equal care was taken to prevent flies breeding in the fouled ground around the compost heaps. The siting of these depots took into consideration the fact that kitchen waste is on average, twice as heavy, and over ten times as bulky, as the derived compost, and that water is required in considerable quantities. It was not possible to locate them more than a few yards from any of the huts, and the offensive smells had to be endured. They were all situated on gently-sloping ground to allow sour liquors to drain away from the base of the heaps, and so prevent the ground around the heaps from becoming a quagmire. The ground was raked clean each day, and any fouled ground, e.g. the site of an old heap, was sprinkled with wood ashes, and covered with 1 ft. of dry lalang until a fresh heap was started there.

The composting process was basically the same as that described in Agricultural Leaflet, No. 6, "Composting", published by the Department of Agriculture, but with certain important modifications to ensure the absence of fly-breeding in the heaps, in view of the fact that all of the depots were so close to the kitchens and huts, and well within the range of flight of the house-fly.

The following points were taken into consideration in evolving the special method practised in the camp:—

1. The life cycle of the house-fly from the egg to free flight is approximately ten days, varying with the conditions.

2. The eggs are destroyed in the hottest part of a compost heap, but not in the cold outer shell. Here the eggs will hatch out, and when the conditions become too uncomfortable, the resulting larvae will wriggle through the material to the surface to pupate.

3. The range of flight of the flies which result is well over half a mile.

4. Fly larvae can also pass freely through soil in order to reach the surface, prior to free flight.

5. Neither flies nor their larvae will attempt to penetrate a bed of loose dry lalang.

The heaps were accordingly all built up from ground level, without excavating the usual shallow pit, so that larvae could not escape into the soil from the base of the heaps. Each heap was turned within 10 days of laying down the first lot of vegetable waste, and thrice more at 10-day intervals. Most important of all, each heap was provided with a jacket of lalang, consisting of four walls and a roof, 1 foot thick. This shell was carefully built-up to receive each additional charge of waste, and was not wetted or composted.

Thus the shell was quite independent of the material being composted, and so could be carefully peeled off. It was opened each day while a heap was being made up to allow fresh additions to the core, after which it was again sealed. Similarly, when the heap was being turned, the cold shell was first removed entirely before the hot core was broken-up. Meanwhile, three new walls of lalang were started to receive the reconstructed heap, which, when finished, was once again sealed with lalang.

This jacket of lalang served to prevent flies from laying any more eggs among the decomposing rubbish, making them keep their larvae inside the heap, and so ensure their destruction. It also acted as a thatched roof, and so afforded protection against rain, while on cold nights it retained the heat. Furthermore, it allowed free aeration, so that foul gases could escape from the heap and be replaced by fresh air.

It is essential to be able to distinguish between the larvae of the fruit-fly which is harmless from a hygienic point of view and those of the house-fly, because fruit-fly larvae are usually to be found in the finished compost in considerable numbers. This is owing to the fact that they seek warm conditions, may remain inactive and dormant for long periods, and are not easily destroyed by heat. The larvae of the two are similar, but whereas the fruit-fly larvae are round at one end and pointed at the other, the house-fly larvae are round at both ends. The former have scarcely any visible markings or corrugations, whereas house-fly larvae are ribbed like Michelin men. Fruit-fly larvae have a jumping habit, and when exposed to light, will roll themselves up, spring open suddenly and so shoot themselves considerable distances in their efforts to escape. It is considered that these heat-resisting larvae were useful in effecting additional aeration of the compost heaps.

Grubs of the Rhinoceros or coconut beetle would often be found in the cold sodden ground round the base of, but not underneath, the heaps. The beetles attack coconut palms, so the grubs were collected and fed to poultry.

The Manufacture of Compost.

The standard procedure was to build up the heap by daily additions for 9 days, turn it on the tenth, twentieth, and thirtieth day, and issue it after 45 days. On the first turning, the material was very raw, sour, and evil-smelling, and the work was very heavy; on the next occasion, the material was still stringy and difficult to handle; on the last, the compost was almost ready, but not quite uniform in texture; and finally, when issued, it was dark-brown, friable, and fibreless, possessed a pleasant earthy smell, and was no longer of much interest to flies.

Forty-five days is exactly half the time required by the standard process, and the explanation of this much more speedy production would appear to be that the cold outer shell of lalang which constitutes about one-half of the heap, is not composted, whereas, in the ordinary way, the cold shell and the hot core are mixed every time a heap is turned.

Except for cattle manure, normally required to inoculate the heaps and reduce the C/N ratio, materials were in plentiful supply. The most important ingredient was undoubtedly human urine. Only a little was required for composting; the remainder was used for watering the gardens, after dilution with water in the ratio of 1:4. It was fortunate that although flies are attracted by the smell of urinals, they do not lay their eggs there, and when urine is diluted it ceases to attract flies. In composting, urine was added with a slurry of wood ash after each fresh charge of kitchen waste, and it was also sprinkled in the form of urinated earth over layers of very soft, wet material.

Another ingredient of almost equal importance was wood ash, obtained from unit kitchens, where rubber wood was used as fuel. Unfortunately, it was necessary to reserve the whole of the available supply for soap-making during the final year, and it became necessary to collect and burn coconut fronds, husks, shells, twigs and roots to remedy the deficiency. Though it was found possible to make compost without ash by substituting urinated earth, decomposition was slower. Besides acting as an anti-acid and deodorant, wood ash is rich in the essential mineral, potash.

The vegetable waste which was composted ranged from fruit skins, vegetable peelings, and rotten fruit to drier material such as leaves, stalks, vines, garden weeds, and lalang. Rotten fruit and vegetables, and the juicy trunk of the banana needed to be chopped and crushed in order to accelerate decomposition, and pineapple skins, which are difficult to compost, were successfully reduced in contact with drier material by the liberal use of wood ash. Woody and resistant matter, such as coconut husks, shell and roots, twigs and rotting wood, were omitted as these require much longer treatment. It is perhaps hardly necessary to add that spoiled rice and cooking pot scrapings were fed to poultry. In any case, rice breaks down completely to water and gas, and merely increases the difficulties of composting.

By careful sorting of all waste into appropriate bins, as previously described, it was possible to arrange a proper sequence of wet and dry, hard and soft, open and close-textured material. Close material, such as tea leaves and fresh grass clippings which tend to seal a heap were evenly sprinkled in thin layers in the same way as the droppings from the poultry runs and rabbit hutches.

The temperatures attained within the heaps were a measure of the micro-biological activity. Wooden testing rods were used to prove the heaps. If they emerged cold and wet, either the reaction had not started or there was too much moisture; if only slightly warm, dry, and shewing traces of white mould, the heap needed more moisture; and if the conditions were just right, the stick emerged hot, moist, and stained dark-brown. Conversely, if the stick was free from slime and rank smell, and could be pushed back easily, the compost was ready to be used, but if there was any resistance, the material was not ready.

The addition of urinated water was a matter of judgment and experience. It was usually added each day after the final layer of waste had been liberally sprinkled with ash, the amount depending on the quantity of succulent material present, care being taken not to add too much and not to wet the lalang walls. The heaps were usually watered again on turning if visible white mycelial strands of fungi indicated an insufficiency of moisture.

Compost Production and Application.

The inner gardens, made up of a vast number of small plots, totalled about 12 acres, being divided into four groups, each with a composting depot.

In fourteen months, the total production of compost by one group amounted to 132 tons which, applied to 3 acres, was equivalent to an application of 2 lbs. per square foot. In addition, a considerable quantity of diluted urine was also added to the soil, in the form of twice-daily waterings. It is estimated that out of an annual production of urine of about 500 tons, about 300 tons was applied to the soil in this way; only about 10 tons were required to make compost, and the remainder was wasted.

It is further estimated that in addition to this quantity of urine, about 200 tons of kitchen waste, 50 tons of lalang, 4 tons of wood ash, and 8 tons of poultry droppings were required to produce this 132 tons of compost, estimated on the basis of 64 lbs. per cubic foot. The total yield of vegetables was 144 tons, estimated on the basis of the yield from a measured area of ¾ acre, which was at the rate of 48 tons per acre.

In brief, 2 tons of raw materials produced 1 ton of compost, which together with 2 tons of urine yielded 1 ton of vegetables. This leads one to the question of cost of production. In a prison camp this was to be measured in terms of man-hours of work, and the itemised account for the group referred to above was as follows:—

	Labour per week
Collection of bins	35 man-hours
Cutting and collection of lalang ..	10 ,, ,,
Building compost heaps	5 ,, ,,
Turning the heaps	36 ,, ,,
Delivery of compost to the gardens ..	3 ,, ,,
Total ..	89 ,, ,,

Thus, in 14 months, 5,400 man-hours of labour were required to produce 132 tons of compost without which it would have been quite impossible to obtain 144 tons of extra vegetables for 1,200 men.

The compost was not applied heavily to a piece of ground in a single application, but was spread thinly and evenly over the ground, and confined to the top spit of soil by shallow digging so as to bring the whole of the land into effective cultivation as quickly as possible. In the course of a year, the land was manured four times, on each occasion just prior to replanting. This system of gradual incorporation was found to be much more effective than a single heavy application.

As the needs of the camp became more urgent, the gardeners concentrated on the very high-yielding green amaranth and tapioca, and for many months the diet of the prisoners consisted of " greens ", rice and tapioca root, variously made-up and flavoured with sugar, sea-water, garlic, chillies, pepper, or curry powder, and with a trace of odoriferous " blachan " (shrimp paste), dried fish, or palm oil.

The amaranth was not harvested young and tender as a two weeks old seedling, as is the usual custom, but was left in order to obtain the maximum yield, as the leaves become larger and coarser as the plant matures. The plant was trimmed once every three weeks, four crops being taken in all, before the plant reached the seeding stage and had to be pulled up.

It was found that the peeled stalk was edible, and could be eaten as " asparagus ", incorporated in soup, or used as pulp for " jam ". In this way, about 75 per cent. of this plant was consumable, the remainder going back to compost. Ceylon spinach was only 50 per cent. consumable, because the vines are inedible, and furthermore the crop of leaf was much smaller, and the plant required a longer period to reach full development.

It was found that amaranth was a useful indicator of soil conditions. Without compost, the crop succeeding the first weedy harvest was a failure. The surviving plants were stunted, irregular and unhealthy, and only between 12 and 18 inches in height. With successive dressings of compost, five successive plantings on the same piece of land became steadily healthier and more productive, even though there was no crop rotation or resting of the soil. The last crop, collected just before release, consisted of plants between 5 and 6 ft. in height, with large leaves and sturdy trunks, and a

2 ft. root system, as compared with the 9 inch root system of the initial crop on uncomposted soil. It almost appeared as if it were possible to go on planting this crop indefinitely. Urine alone, added without compost, did not give satisfactory results as only a quarter of the crop was obtained.

While a single analysis does not provide conclusive evidence of the effect of composting, nor does it indicate the physical changes in the texture of the soil, nevertheless the result of a comparative analysis of two samples of soil is submitted. These samples were examined in the laboratories of the Department of Agriculture, Ceylon, shortly after the conclusion of hostilities.

Soil Type	Two immediately adjacent soils	
	(a) Untreated Yellow lateritic loam per cent.	(b) Treated Grey-brown lateritic loam per cent.
Stones and gravel ..	3.84	1.85
Reaction (pH) ..	4.8 (acid)	5.8 (slightly acid)
Carbon (Walkley) ..	0.417	1.29
Nitrogen ..	0.027	0.076
C/N ratio ..	15.4	17.0

The treated soil had received five successive plantings of amaranth, without resting; the untreated soil had not been cultivated at all.

Summary.

It has been shown that:—

1. An infertile and unproductive soil can be made to give high yields of " greens " by incorporating compost made from kitchen waste.
2. Compost can be produced in 45 days in the tropics by covering the heaps with a jacket of lalang.
3. It can also be produced without flies, and at a cost of 40 man-hours per ton.

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Selected Articles.

IMPROVISED BIOCHEMICAL WORK OF A PRISONER OF WAR*

The Author was taken in Singapore as a military prisoner of war by the Japanese in February, 1942. He was later sent to Thailand on the construction of the Burma-Thailand railway. Towards the middle of 1944 circumstances brought him to the recently-constructed base hospital camp at Nakom Patom, about 60 kilometres west of Bangkok. The camp was full of patients, contained a good number of doctors, had a limited supply of drugs and medical equipment but no biochemical apparatus.

The following account of biochemical work carried out under prisoner-of-war conditions has been written in the belief that the circumstances under which, and the methods by which, the results were obtained may be of interest.

During my stay in Nakom Patom camp from June, 1944, until March, 1945, I was given the opportunity of carrying out certain biochemical work in conjunction with the medical staff of the camp. The following is a brief account of the type of work carried out and of the difficulties encountered. The first part deals with gastric analyses and the second with renal efficiency tests, but the two lines of investigation were carried out concurrently.

At the start of the investigations there was practically no apparatus and very few chemicals. The apparatus required had to be constructed from any available local materials; the most useful source was the blood transfusion sets which had been sent into the camp. The bottles from these sets were cut in half, the bottoms being used as flasks or beakers and the tops as filter funnels. The rubber caps were bored with red-hot nails and used as bungs and corks. A supply of rubber tubing was also obtained from these sets.

Empty ampoules of distilled water were cut and trimmed to serve as test tubes and boiling tubes. There was available a small amount of glass tubing of assorted sizes, in about three-foot lengths, and a few sheets of filter paper. The only balance in the camp was an old pair of dispenser's scales accurate to about 0.2 gm. There was no running water. The only sources of heat were open wood fires, charcoal braziers, or a small spirit burner. At the time of my arrival a rice fermentation process had been started which produced a fair yield of ethyl alcohol, which, by distillation, was concentrated to a strength of between 80-90 per cent. A modified fermentation process was giving small yields of a weak acetic acid solution of about 4 per cent.

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* By R. G. H. Wilshaw, Acting Chief Research Officer, Department of Agriculture, Malaya. *The Pharmaceutical Journal*, August 24, 1946.

Gastric Analyses

The first work to do was to devise a method of carrying out gastric analyses. It was decided by the doctors that the most suitable test meal under the prevailing circumstances was 100 mils of 7 per cent. alcohol. This presented no difficulty. The tube to obtain gastric contents was the rubber tubing from the blood transfusion sets; it was of narrow bore and worked admirably. During the course of five months I passed tubes on over 200 patients without any difficulty or failures.

Since a suitable stomach-tube was available and also a suitable test meal, the problem became a matter of glassware and chemicals. To carry out any volumetric work some graduated glassware was necessary. A number of hypodermic syringes were available in sizes from 1 mil to 20 mils. With the aid of these and glass tubing a number of graduated burettes and pipettes were made. The graduations, which were scratched gently on the surface of the glass, agreed well with the theoretical measurements calculated from the internal bore of the tubing. All the apparatus was graduated " to deliver ", and by the use of a metal " T " piece a successful automatic 5-mil burette was made.

The chemicals required were a standard alkali and acid, and a suitable indicator. At this period there were no strong acids available; the only alkali was sodium bicarbonate, which, by ignition, could be turned into the carbonate, from which a N/10 solution was made up. With this solution, provided a suitable indicator could be found, titration for total acidity of gastric contents could be carried out. On searching through some chemicals a small bottle of Alophen was discovered; this was known to contain a phenolphthalein. On making up a 1 per cent. solution in alcohol and testing it as an indicator, it was found that the phenolphthalein complex was too slow in breaking up and liberating the coloured ion in alkaline solution for it to be used in the normal manner. It was found, however, that by adding the indicator to the alkaline solution and allowing it to stand, the full red colour then slowly developed. Once this had occurred the titration could be carried out by using the coloured alkali and titrating to the first appearance of colour in the acid solution.

The titration of gastric secretions with sodium carbonate and this indicator was not, however, completely satisfactory, because the presence of CO_2 interfered with the end point. Boiling the solution to eliminate the gas merely caused a partial breakdown of gastric proteins with the production of amino-acids; the latter caused further interference. However, this method was used as a start. A short while after, a bag of slaked lime was discovered, and a bottle of concentrated hydrochloric acid was obtained from Bangkok. This was a great advance, as a standard volumetric solution for all work could now be made by suitable dilution of the concentrated acid. For this purpose the concentrated acid was taken as being 10N, and the solution obtained by diluting it 100 times was taken as standard N/10 solution for all subsequent work. A saturated solution of the lime

was used as standard alkali. The solution was allowed to stand at all times in contact with excess of the solid, and was titrated and standardised whenever necessary before use. It was found that at the even temperature in Thailand, the solution maintained an approximate strength of N/30.

It was considered desirable to determine the free acidity of the gastric secretions. This could only be done if an indicator with a colour change at about pH 3 could be found. Such an indicator was subsequently obtained by making an alcoholic extract of a plant that grew locally; its discovery, referred to later under the determination of blood urea, enabled free acidities to be determined. With standard acid and alkali and suitable indicators no further difficulties were encountered in carrying out the gastric analyses.

Peptic activity of the secretions was estimated by determining the time required for them to dissolve a small piece of coagulated egg-white of standard size. The size was that of a section of a cylinder about 2 mm. diameter and 2 mm. long. The pieces were cut out of the egg-white by means of a small metal cutter shaped like a cork borer. It was found that a "normal" secretion would dissolve the protein in about three hours; in cases of hyperchlorhydria the action took considerably less time; in cases of hypochlorhydria often longer, and in cases of achlorhydria, no solution took place on standing overnight.

The general procedure was for the patient to present himself for examination first thing in the morning, after only a light rice meal the previous evening. A tube was passed and the resting contents of the stomach removed by means of a 20-mil syringe attached to the end of the tube. When the stomach was empty, the patient was given 100 mils of 7 per cent. alcohol to drink and allowed to sit with the tube *in situ* for half-an-hour. At the end of this time the total stomach contents were again removed.

Total and Free Acidity

As soon as the resting contents were obtained, observations were made on the volume, colour, odour, and mucoid nature, the presence or absence of food particles, bile and blood. They were then filtered through cotton-wool the mucus-free runnings titrated against standard N/30 alkali, first, for free acidity, and then for total acidity. A small quantity was then set aside for determination of peptic activity. Similar observations and determinations were made on the contents obtained after the test meal. In general it was found that the values for total and free acidity differed by 10-20 mils of N/10 per cent. The normal range of free acidity was taken as extending from 20 mils to 60 mils N/10 per cent. after the test meal. Higher values were returned as cases of hyperchlorhydria, and lower values as hypochlorhydria or achlorhydria from the peptic activity shown.

In view of the acute shortage of acid in the camp, a convenient and successful method of treatment of cases of achlorhydria and hypochlorhydria was found to be the administration of the filtered gastric secretions obtained

from patients suffering from hyperchlorhydria. These secretions were also used at one time with a moderate degree of success as a soldering flux. During the course of the work a few cases of stasis were encountered and surgery subsequently confirmed two cases of " leather bottle " stomach and one case of carcinoma.

Renal Efficiency Tests

Towards the end of 1944 investigations were commenced on the possibilities of carrying out a renal efficiency test. This required the determination of blood and urine urea and the calculation of the rate of blood clearance or a Van Slyke index.

Hydrochloric acid and calcium hydroxide were available; there was plentiful local supply of soya beans. These circumstances practically dictated the use of the urease-titration method for the determination of urea. In this method blood urea is changed by the enzyme, urease (contained in soya bean) into ammonium salts. On alkalinising the blood solution the ammonium salts can be volatilised off and absorbed in standard acid. By back titration of the acid, the amount of ammonium salts can be calculated, and hence the urea.

There was little difficulty in fitting up the extremely simple glass apparatus required for this method. It consisted in its elements of three inter-connected boiling tubes. The first contained acid; it acted as a trap to remove any ammonia from the air as it was aspirated. The second tube was the reaction tube; it was surrounded by a warm water bath, in which the urease acted upon the blood urea. The third was the absorption tube in which the ammonia displaced from the second tube was absorbed by standard acid.

An Improvised Suction Pump

Two obvious difficulties were first to devise some satisfactory method of aeration, and second to find an indicator which was suitable for titrating the acid in the presence of ammonium salts. A third difficulty, which arose in practice, was to find some means of preventing the frothing of the blood solution under aeration. To overcome the first difficulty, an attempt was made to suck air through the solutions by means of a controlled flow of water dropping from a container; it was found that the maximum flow of air obtainable, consistent with the practical difficulty of constantly filling a small container with water, was insufficient to remove all the ammonia from the blood solution. In the end, a mechanic constructed a small hand suction pump out of an old blood transfusion tin, fitted with a wooden piston lined with leather. This worked admirably; it only wanted a willing worker to keep up the pumping. All traces of ammonia could be removed from the blood solution, if maintained at about 55°C. in about ten minutes.

The second difficulty was the most troublesome. For titration of ammonium salts in acid solution an indicator is required which has a colour change in the neighbourhood of pH 3 to 4. In the end I made some extracts

from a number of plants growing in the camp, and eventually found one, the leaves of which gave an alcoholic extract showing distinct possibilities. In acid solution the extract was red, in alkaline solution it turned green with a sharp colour change within two drops of N/30 calcium hydroxide. The question was at what pH did this colour change take place? It was lucky that among some notes I had with me was a table showing the relative proportions of acetic acid and sodium acetate required to make up a series of buffer solutions. Using acetic acid from the rice fermentation process and neutralising with sodium carbonate, a solution of sodium acetate was prepared. Combining this in the required proportions with acetic acid a series of buffers from pH 3 to pH 6 was prepared. By the use of these it was determined that the indicator concerned was red at pH 3, practically colourless at pH 4 and green at pH 5. This was a lucky find; it solved the biggest difficulty. A botanist subsequently identified the plant as *Ocimum gratissimum*, which is a source of thymol. The colour changes of this indicator, however, were not those of pure thymol.

The frothing of the blood solution under aeration, threatened for a short time to ruin all chances of making the method work. The usual anti-froth used is caprylic alcohol; none was available. After trying various substitutes it was discovered that a few drops of coconut oil was a perfect anti-froth.

Turmeric Paper

Turmeric was found growing in the camp, and from an alcoholic extract of this, strips of turmeric paper were prepared, which served as very useful visual controls (tell-tales) in the process of aeration. One strip placed in the glass tubing between the reaction tube and the absorption tube turned brown as soon as the ammonia commenced to pass over; when the flow of ammonia ceased the strip slowly changed back to its original colour, and thus served as an indication of the end point. A second strip placed after the absorption tube served as a check against any loss of ammonia.

It was found necessary, when using the aerating pump, to insert a large vessel in the system to act as a reservoir and buffer, otherwise the action of the pump caused too violent surges of air in the reaction tube. With this slight modification the lay-out of the apparatus followed the well-known normal lines.

Numerous blanks, checks, and replicates were run through in the apparatus before it was considered satisfactory. Having regard to all factors it was deemed advisable to carry out urea determinations on larger samples of blood than are usually taken: 5 mils were used for the estimations; this quantity gave a titration figure of about 1.5 mils N/30 calcium hydroxide. Since the tubing from which the burette was made showed a fall of liquid of about 3 inches per mil there was no difficulty in measuring accurately to 0.05 mil.

The details of the final method adopted were as follows: take 5 mils of whole blood or plasma, dilute it with 5 mils of distilled water, add crushed soya bean; allow to stand in a water bath at 55°C. for 20 minutes. Remove the tube, add a few drops of coconut oil and 2 to 3 gm. of slaked lime, cork quickly, and replace in aerating apparatus. Start aerating—it will be noticed that the first turmeric paper rapidly changes to brown—continue aeration until the turmeric paper regains its original colour (about 15-20 minutes). Remove standard acid absorption tube, which originally contained 5 mils N/10 acid diluted to about 40 mils. Back titrate against N/30 calcium hydroxide, using indicator mentioned.

Replicated estimations by this method gave results for blood urea agreeing to within one mgm. nitrogen per 100 mils blood. Urine urea determinations were carried out in a similar manner using a smaller quantity of urine.

Before concluding this account of the work carried out at the camp, I should like to record an episode which illustrates a rather remarkable feature of prisoner-of-war life. Shortly before leaving the camp I was engaged in trying to devise means of carrying out a Kahn test. For this purpose I was looking round for some possible source of cholesterol, and decided that I might obtain some from gallstones. I approached a sergeant who had recently been operated on for this complaint and had had over seventy stones removed. On asking him if he would let me have some of the stones for chemical purposes I met with the somewhat unexpected answer: " Sorry, sir, I've flogged them all."

It is a pleasure to record my sincere thanks to Lieut. Col. Coates, Australian Army Medical Corps, who was Allied Commandant of this camp, for his great encouragement to me in carrying out this work; and also to Major A. T. H. Marsden, R.A.M.C., Colonial Medical Service, and Captain J. Marcovitch, R.A.M.C., for their very helpful suggestions and criticism. Any observations or comments on the medical aspect of this work should rightly come from these officers. I have to thank them for an interesting insight into pathological work and for contriving to make the time spent on this work an enjoyable period of prisoner-of-war existence.

POSITION OF TEA AND RUBBER INDUSTRIES IN THE NETHERLANDS INDIES*

Various and conflicting reports are seen from time to time regarding the condition of tea and rubber plantations in the Netherlands Indies. In this connexion the following extracts from an article appearing in *Capital* will be of interest to our readers. The writer claims to have endeavoured to form an impression of the present and future economic prospects of the Netherlands Indies after having completed a three-weeks' tour of the country.

The total area under tea cultivation at the time of the Japanese occupation in Java, amounted to 260,802 acres. Reports are available over an area of some 171,580 acres prepared by the administration of the various gardens; it would appear that by the middle of 1945 an area of 134,120 acres was still under cultivation. Regarding the balance no reports are available. As from 1943 a large quantity of tea bushes were either uprooted or cut off at the roots. The land obtained in this fashion was frequently used for foodgrains and pulses; in some gardens pyrethrum was planted. With a few exceptions, where gardens remained under proper supervision, bushes have in most cases been allowed to grow wild, as a result of which (depending on soil and elevation) heights of 5 to 7 metres can be anticipated. It is certain that in view of the lack of regular pruning and of general neglect, a great deal of time and work will be necessary before these bushes can be considered productive. In those regions where entire gardens have been destroyed, it will be impossible to sow tea without revitalising the soil which has been exposed to floods and rains. This again will be a lengthy process.

The producing of tea was severely licensed and limited. In the year 1943 it did not exceed 4.3 million kgs., and 3.4 millions kgs. in 1944 consisting of about one-third native-grown tea. In comparison, the production figures for 1940 and 1941 were 62 million kgs. and 67 million kgs. respectively. This production was limited by international accord. Of the 220 tea factories operative in Java in 1941, about 50 remained operative, though the amount of leaf handled was small. The majority of the remaining factories were pulled down and partially dismantled, but it would appear that some 20 were converted by the Japanese for war production. On the East Coast of Sumatra, of the 1941 acreage of 53,050 about 33 per cent. has been uprooted or cut down. As in Java, a number of factories were converted for war production. There is very little news of the remaining tea gardens in Sumatra, though it is known that of Moera Laboch's 4,000 acres, about 22 per cent. was destroyed. It is, however, interesting to note that the tea produced in Sumatra in 1944 is assessed at 6 million kgs., which is in excess of Java, whereas the normal produce of Sumatra was about one-third that of Java. The potential standard production of Sumatra in 1941

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* *The Planters Chronicle*, October 15, 1946.

was assessed at 6 million kgs. From the above it is obvious that the devastation wrought to the tea culture in Java and Sumatra, though hard to determine accurately, is of considerable proportions. On the other hand those concerned with the problem point out that the potential of these islands pre-war, exceeded considerably the amount produced, which was limited by international agreement. Assuming an over-all destruction of gardens and factories up to 33 per cent. the views expressed indicate that within a year or two of opening up of the interior of Java and Sumatra, production should approach the controlled production figures of 1941.

The total acreage under rubber taken over by the S.K.K.K. in 1942 was 610,002. Reports are available over some 95 per cent. of this acreage from which it appears that, at the middle of 1945, about 7 per cent. had been cleared for other purposes. Originally the Japanese cleared only the plantations which showed low returns and those which had been earmarked for clearing by the former owners. Later this policy was extended to other plantations in order to procure fuel for war industries. Apart from this in the more closely populated districts the population destroyed many trees for fuel. In the years 1942 and 1943 the plantations cleared by the Japanese were largely replanted with young trees of good quality. Later, however, this policy was discontinued, the land freed being used for growing food-grains and pulses. On some plantations, vegetables were grown among trees which must in time affect their yield. Up till 1944 quite a number of European managers remained at work, but these were replaced at the end of the year by Japanese and Indonesians. It must be borne in mind that the neglect of mature plantations, and the growing of extraneous plants amongst the trees, are of little consequence to their ultimate yielding capacity, though this is of course different in the case of younger trees. It is, therefore, safe to say that the majority of existing plantations are in reasonably good condition and could become fully productive in a relatively short time. During the War the centre of production was concentrated in West Java. In 1943 and in 1944 the production was 25,423 tons and 24,330 tons respectively, which represents about one-fifth of the potential production for the whole of Java according to 1941 figures. In some cases factories were dismantled, but this was not done as extensively as in the case of tea factories; several factories were converted to produce crepe soles, for which there was a great demand from the army.

On the East Coast of Sumatra, the acreage under rubber in 1942 was 638,152; it appears to have suffered more largely than Java, and it is estimated that about 14 per cent. of the plantations have been lost there. The rubber production in Sumatra for 1944 is estimated at only 13,500 tons (including 3,500 tons of latex rubber).

The concensus of opinion is that as soon as the plantations have become accessible, a volume of production equal to 50 per cent. of the pre-war production can be achieved within one year, and that full production can be reached at the second closing year of resumed work.

Notes and Comments.

GOVERNMENT GUARANTEED PRICES FOR PADI.

In order to encourage growers to sell to Government the greatest possible quantity of padi from the current season's harvest, the Government purchase price was increased with effect from 1st January, 1947, from $10 to $20 per picul of padi delivered at the mill. The price for padi purchased in the field was increased from $9.20 to $19.20 per picul. These new prices are guaranteed as the minima which will be paid during 1947.

Government has also increased the bonus paid to Government buyers of padi from $1 to $2 for every 10 piculs of padi brought in by them to the mill.

CESSATION OF TEA CONTROL.

The second International Tea Agreement, which restricted tea planting and regulated exports of tea, terminated in 1943 as far as Malaya was concerned. Accordingly, to remove the restrictions on the planting of tea in the Malayan Union, the Tea Control (Repeal) Ordinance, 1946, came into force on 10th December, 1946, and repeals all former legislation restricting the planting of tea in the Union.

LOWER PERAK AGRICULTURAL SHOW.

The Lower Perak Agricultural Show, held at the Government Rice Mill in Teluk Anson on Saturday and Sunday, December 7th and 8th, was opened by His Highness the Sultan of Perak in the presence of the Acting Governor-General and Lady Gent, the Resident Commissioner of Perak and H.H. the Raja Muda of Perak. More than 25,000 persons visited the Show. There was a large number of exhibits and most classes were represented, the fruit section being exceptionally large. Prizes were in general monetary, but the Malayan Agri-Horticultural Association had generously presented cloth and certificates for special exhibits. The Acting Governor-General gave a prize for the Teluk Anson Garden Competition which was won by Mr. Ramalingam of the Town Board. Twenty-one Government Departments or Institutes, including the Sakai Home in Tapah and War Crimes were represented. Entertainments included a kronchong, sepak raga and volley ball competitions, a cinema show, a ronggeng, a Chinese concert and the Sri Arjuna Revue. The bands of the Seaforth Highlanders and the Police played during the Show and the Anti-Tank Battery of the Royal Indian Artillery provided a guard of honour.

VERNACULAR JOURNALS OF THE DEPARTMENT OF AGRICULTURE.

Simultaneously with the re-appearance of the *Malayan Agricultural Journal*, publication of the three vernacular journals of the Department of Agriculture is recommencing in January, 1947, though printing difficulties may delay the actual date of publication. The journals are *Warta Perusaha'an Tanah*, *Ma Loy Chow Nung Nyip Tsung Poh* and the *Tamil Agricultural Journal*, and copies are supplied free of charge to genuine agriculturists and persons interested in agriculture in the Malayan Union. Applications should be addressed to the Department of Agriculture, Kuala Lumpur.

BROADCASTS TO VERNACULAR SCHOOLS.

A series of four broadcast talks to children in the vernacular schools on matters relating to school gardening has been prepared by Mr. J. R. P. Soper, State Agricultural Officer, Selangor. The talks are to be given during the school hour on Sundays at the end of January and early February. They will also appear in the vernacular journals of the Department of Agriculture and as a leaflet in English.

They were written more with the object of stimulating an interest in natural phenomena than of giving details of gardening practice. An imaginative approach more likely to appeal to the developing 11 year old mind was adopted in an attempt to counteract some of the ill effects produced by the cold matter-of-fact presentation which is more usually followed.

Departmental.

FROM THE DISTRICTS.

Compiled by the Agricultural Economist from Monthly Reports of Agricultural Officers.

December, 1946.

The Weather.

In most parts of the Peninsula heavy rains fell during the month. Dry weather was experienced in parts of Perak, and in Pahang the rainfall was substantially below the average. In Malacca also the rainfall was light, increasing only at the end of the month. Flooding was reported in many parts of the country and serious floods occurred in the main coastal padi area of Selangor.

Crop Reports.

Foodcrops and Vegetables.—In Kelantan considerable quantities of what are known as monsoon root crops, i.e., tapioca, sweet potato, yams, colocasia and groundnuts, were harvested and marketed during December.

Vegetable production increased in Penang with the cessation of the heavy rains. Planting of foodcrops is being carried out on the padi field bunds and nearly 10 piculs of maize seed were distributed free to padi planters in one district for this purpose.

In north Perak Chinese squatters showed sustained interest in the planting of tapioca, sweet potato and colocasia. Exports from Perak during December were (in piculs): vegetables 10,492, tapioca flour 12,252, fruits 5,982, miscellaneous foodstuffs 2,655.

In Selangor large areas of sweet potatoes were harvested during the month and the price to growers fell to $4 per picul. One estate is converting the tapioca crop to flour by having dried chips milled which it proposes selling to Government at the fixed price of $20 per picul.

In Malacca with the advent of the padi harvest, less interest was evinced in foodcrop cultivation, except amongst professional gardeners. There was a marked increase in the production of beans and peas by Chinese market gardeners, but a decline in leaf vegetables followed the very wet weather in November. Off-season cultivation of padi fields was extended by a further 21 acres during the month. A much larger area would be cultivated in this way were it not for the high rental demanded by the Malays from whom the Chinese gardeners lease their holdings. The completion of the main padi harvest should see a substantial increase in the acreage under off-season cultivation. So slight is the demand for tapioca that the crop is being offered at 50 cents per picul in Jasin *ex* plantation. An interesting departure from normal practice is the opening up of a small vegetable garden by a number of Malay women in one district.

In Johore North the area under foodcrops is steadily decreasing as little replanting is being carried out to replace the harvested areas. With a drop in the price of uncontrolled rice, there is little or no demand for tapioca and sweet potato, and the latter is being used as a pig food. In Johore Central, on the other hand, there was a slight increase in the acreage under foodcrops. In Johore South also a satisfactory area was planted with vegetables and foodcrops.

Wet Padi.—In Kedah harvesting has already commenced of the early planted wet padi. Local padi planters were satisfied with the latest price guaranteed by Government and many who neglected to plant padi are now sorry that they did not do so. Arrangements are being made by local planters to work uncultivated land in the coming season which will increase the cultivated area substantially. In some districts excessive water has impeded harvesting.

The more or less continuous recent wet weather has improved the appearance of the crop in Kelantan. Some areas were flooded during the month, but the plants were sufficiently well-grown to escape serious damage. The harvest of the early wet padi is now nearly complete, and planters who have average yields of 100 to 200 gantangs per acre express themselves as satisfied with the result.

Transplanting of late planted wet padi has now been completed in Trengganu and prospects are generally good. Flooding has caused losses of early planted wet padi. Normally the crop is harvested before there is any serious flooding, but as this type of padi has to be planted on the lowest land, which is certain to be flooded sometime during the year, the risk is always present. In one district about 80 per cent. of the earlier planted crop has now been harvested with yields generally better than last season. In Kuala Trengganu District, flooding has been extensive and in some mukims it is thought that half the crop has been lost over an area of 2,000 acres.

In Province Wellesley North, harvesting of areas of short term padi varieties has commenced, but the yield is estimated at not more than 250 gantangs per acre. These short term varieties were grown in the hope of obtaining a high price early in the harvesting season, but the price of $20 per picul offered by Government together with the comparatively light yield obtained has made this experiment considerably less profitable than growing the usual 6-months padi. Planting has been completed in nearly all the other parts of the Settlement. For the late areas it is fortunate that the wet weather continued to the end of the month, and crop prospects are much more promising than might usually be expected from so late a season. The import of bat guano from Kedah was completed in the early part of the month and altogether a total of 774 tons have been imported for the plough land of Province Wellesley North and Central. The total imports by the Department are estimated to have served 9,000 acres of padi land in these districts.

In parts of Perak the padi is now between the tillering and flowering stages, but in some localities planting of wet padi is still proceeding. The uneven planting is due to the early dry condition followed in some parts by flooding. Planting in the late areas of the Sungei Manik Irrigation Scheme was completed during the month and draining of the earliest planted areas commenced in the first half of the month.

In Selangor, planting is in full swing at Panchang Bedena in the main coastal area, about 50 per cent. having been completed. Serious flooding occurred in the coastal area during the month but the damage was not so severe as at first feared. A total of 650 acres is being resown with short term seed obtained from Sabak Bernam. All available seedlings from unused nurseries were being collected and distributed to fill as much of the damaged plots as possible. The seedlings were used where resowing was inadvisable owing to the difficulties of subsequent water control. Harvesting has commenced in other parts of the State and in some areas is almost complete. The sowing of a second crop in one district was completed by the middle of the month.

It is estimated that about 30 per cent. of the crop in the Lipis District of Pahang has been harvested. The crop in this District will be very much better than the previous season. In Pahang South also harvesting has commenced and 80 per cent. of the crop in the Temerloh District was harvested by the end of December. The crop is a good one in the majority of the areas. Harvesting commenced in the Bentong District about the middle of the month. The Chinese in this Circle are harvesting excellent crops.

With the increase in the Government price for padi from $10 to $20 per picul at the mill and from $9.20 to $19.20 in the field with effect from 1st January, 1947, the sale to Government becomes a practical possibility and arrangements were being made to organize the buying side of the Government Rice Mill, Temerloh, to cope with the new conditions.

Harvesting was in progress in all the three Districts of Malacca. Only mediocre crops are expected from the Central East areas where the majority of the padi suffered from lack of water at planting.

Rubber.—The heavy rains of December restricted tapping considerably, but the number of holdings in tapping remained high. The wet weather increased the incidence of Mouldy Rot, but control measures were adopted satisfactorily in most parts of the country. Pink disease was reported in Kedah and advice on control measures was given.

In Kelantan a number of smokehouses are being built by co-operative effort, and a plan for a standardized type is being prepared by the Asiatic Rubber Instructor. Coagulants are still very short in some parts of Trengganu.

Supplies of disinfectant for the treatment of Mouldy Rot were distributed in Perak. Many holdings suffer from neglect during the occupation

period and no attempt has been made by some owners to slash the undergrowth and generally improve the sanitary condition of their holdings.

Yields of rubber in Selangor are dropping after the first flush of resting.

West Pahang is still short of coagulants and black market prices are being paid for inferior substitutes. Four smokehouses were erected. Numerous enquiries were received in Malacca regarding replanting.

Fruit.—Good crops of the principal fruits, durian, rambutan and mangosteen were reported from all parts of the country. In Trengganu the fruit season was considered the best for some years.

Coconuts.

Two Penang mills ceased to operate at the end of the month and the price of copra cake jumped to $20 per picul. Copra production in one district of Selangor was impeded by the wet weather and flooded kilns. The price of copra varied from $11 to $14.50 per picul at the coastal oil mills. Copra cake was sold at $16 per picul.

In Malacca wide fluctuations were recorded in fresh nut prices, varying from 8 to 10 cents in town to 1½ to 2 cents in producer districts. High transport and labour charges account for this difference. It is reported that in one district prices were considered so unremunerative that it was not worth while harvesting the nuts. Fifteen small copra mills were reported to be in operation in Malacca Settlement, with a total monthly production of 270 piculs.

In the Muar District of Johore North, fairly large quantities of copra are being produced. The quality of this copra is not high, and the owners are not inclined to try to improve it either by building better kilns or by grading. The manufacture of coconut sugar continues although in some localities the price has fallen to 20 cents a kati. In Johore Central the demand for coconut shells for latex cups continues, the price being $17 per thousand. In Johore South, owing to competition from imported edible oils, the price of coconut oil dropped from $8.40 to $5.50 per 4-gallon tin. The local oil mill has closed down owing to this drop in price and the high costs of production.

Poultry.

Local hatcheries in Malacca reported an output of 26,400 chicks and ducklings during the month.

In Johore further importations of Australian chicks have ceased until the end of the wet season. The hatchery in the Kota Tinggi District produced approximately 130,000 chicks and ducklings during the month. Considerable quantities of fowl and duck eggs were exported from this locality to Singapore.

Fish.

The stocking of fish ponds in the Raub District, Pahang, continues and a further 2,000 fry were imported during the month. A number of fish ponds have been made in Perak by Chinese interested in the rearing of carp.

Miscellaneous.

School and Home Gardens.—The visiting of school gardens by members of the Field Staff of the Department was continued during the month. These visits are bearing fruit, and work in the gardens generally shows a considerable improvement. Compost making is now carried out regularly by most schools with beneficial results. In some States fruit areas neglected during the war are being rehabilitated.

In districts of Pahang where padi harvesting is in progress, teachers and scholars have been urged to collect padi straw for composting or for mulching permanent crops.

The State Agricultural Officer, Selangor, assisted in the final judging of the Home Garden Competition held in the Ulu Langat District. There were some very creditable entries in the Malay Section.

Home Garden and Livestock competitions were held in Penang and Province Wellesley and aroused considerable interest in the kampongs. District Officers assisted in judging the Home Gardens, and Veterinary Inspectors in judging the livestock.

Agricultural Competitions.—Two highly successful and well-attended Agricultural Competitions were held in North Perak, one at Bagan Serai and the other at Taiping. The competitions aroused considerable interest and the standard of the exhibits was commendably high.

DEPARTMENTAL NOTES

Obituary.

It is with the greatest regret that we record the severe loss suffered by the Department of Agriculture by the death of the undermentioned officers on active service during the recent war:

J. A. Baker, Agricultural Officer, a private in the Kedah Volunteer Force, killed in action in Perak in December 1941.

C. H. Burgess, Agricultural Officer, Lieutenant, 4th Battalion, F.M.S.V.F., attached to 11th (Indian) Division as Liaison Officer, died in December 1942 of diptheria at Chungkai Camp, Thailand.

N. H. Sands, Agricultural Officer, Lieutenant, S.S.V.F., attached to 18th (British) Division as Liaison Officer with 85 Anti-Tank Regiment, R.A., died in December 1942 of diphtheria at Chungkai Camp, Thailand.

T. W. Brown, Botanist, Sergeant, Signal Coy., S.S.V.F., died in January 1944 of bacillary dysentery at Nong Pladuk No. 2 Camp, Thailand.

C. L. Newman, seconded to Sarawak as Director of Agriculture, Sarawak, and subsequently released for service as a 2nd Lieutenant in the Indian Army. He is presumed to have died or been killed in Borneo on or after the 24th March, 1942.

Yong Yoon Choi, Agricultural Assistant Grade II, Lieutenant, Malacca Volunteer Corps. Lieut. Yong Yoon Choi was mobilized in December, 1941, and served throughout the campaign. He was one of a party of 26 Volunteers who were slaughtered by the Japanese after the fall of Singapore.

We regret also to record the death of Mr. G. D. P. Olds, Agricultural Officer, during the period of the war. Mr. Olds, who was a Pilot Officer in the Malayan Volunteer Air Force, was on active service flying in Malaya after the outbreak of war. He was later ordered to Pekan Baroe in Sumatra, from where he went to Java and thence to Australia. Mr. Olds was subsequently posted to British Honduras as an Agricultural Officer, where he died in 1942 from peritonitis following an operation for appendicitis.

We extend to the relatives of our late friends and colleagues our very real sympathy in their bereavement.

Appointment.

Mr. R. J. A. W. Lever, Entomologist, has been transferred to the Malayan Agricultural Service from Fiji. Mr. Lever arrived in Malaya on 14th December, 1946.

Leave.

Mr. R. B. Jagoe, Botanist, returned from leave on 11th December, 1946.

Mr. B. A. Lowe, Agricultural Officer, Cameron Highlands, has been granted 86 days' leave, exclusive of voyages, from 31st December, 1946.

RETIREMENT OF MR. W. N. C. BELGRAVE, B.A., Dip Agr. Sci. (Camb.).

Mr. W. N. C. Belgrave, former Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States, retires on 29th January, 1947, after leave prior to retirement. Mr. Belgrave first came to the Department in November 1914, and has thus served Malaya for over 32 years. Mr. Belgrave's first appointment was as Assistant Mycologist; he later became Plant Physiologist, and was placed in charge of the Division of Soils and Plant Physiology in 1927. In 1929 he attended the Fourth Commission of the International Society of Soil Science at Konigsberg, and the same year was a Delegate to the Second Imperial Mycological Conference at London. In 1931, Mr. Belgrave became Chief Research Officer, which post he filled with conspicuous success until his appointment in January, 1939, as Head of the Department of Agriculture.

Mr. Belgrave will long be remembered for his work on Malayan soils and manurial problems, particularly in connexion with oil palms and coconuts, and the publications of the Department bear witness to his considerable contribution to agricultural literature.

Mr. Belgrave's intimate knowledge of Malayan agriculture, coupled with an ability for critical analysis of all problems, based on his extensive scientific background, enabled him to be a source of help and encouragement to all officers working under him.

Mr. Belgrave fortunately survived the rigours of internment with moderately good health, though he suffered severely from the serious eye trouble that was prevalent in Changi Gaol. He rendered the Camp valuable service in an advisory capacity in connexion with the development of vegetable gardens, and later at the Sime Road Camp assumed the onerous duties of Commandant of North Area.

His many friends in the Department learned with considerable pleasure of his marriage in 1946, and wish him many happy years of retirement.

RETIREMENT OF DEPARTMENTAL OFFICERS.

In addition to Mr. Belgrave the following senior officers of the Department of Agriculture who were interned in Singapore during the war have retired and are not returning to Malaya.

Mr. F. Birkinshaw, Chief Field Officer, retired on 26th September, 1946, after 34 years service, of which the last 26 years were spent in Malaya.

Major C. D. V. Georgi, O.B.E., Chief Research Officer, retired on 21st November, 1946, after 26 years service.

Mr. D. H. Grist, Agricultural Economist and editor of the *Malayan Agricultural Journal*, retired on 17th September, 1946, after 32 years service.

Mr. G. E. Mann, Principal, School of Agriculture, Malaya, retired on 24th July, 1946, after 25 years service.

Mr. G. H. Corbett, Senior Entomologist, retired on 3rd July, 1946, after 26 years service.

Mr. A. E. Coleman-Doscas, State Agricultural Officer, Johore, retired on 26th July, 1946, after 26 years service.

Mr. N. C. E. Miller, Entomologist, retired on 24th August, 1946, after 18 years service in Malaya.

Mr. R. A. Altson, Plant Pathologist, retired on 16th September, 1946, after 23 years service, of which the last 18 years were spent in Malaya. Mr. Alston has recently returned to Malaya to take up an appointment with the Rubber Research Institute of Malaya, and we wish him every success in his new work.

We extend to all our former friends and colleagues our very sincere wishes for many happy years of retirement.

H. L. B.

Statistical.

MARKET PRICES.

December 1946.

Rubber.—There was a slight advance in the Singapore price of rubber during the month. No. 1 Ribbed Smoked Sheet opened at 41¾ cents per lb. and advanced to 42⅛ cents per lb. in the early part of the month, easing to close at 42 cents per lb.

The average of daily quotations for the month was 41⅞ cents per lb. Average prices for London and New York are not available.

Prices paid for small-holders' rubber at three centres during the month are given in Table I.

Table I.

Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, December, 1946.

(Dollars per picul of 133⅓ lbs.)

Grades	Ipoh, Perak.				Kuala Pilah, Negri Sembilan		Batu Pahat, Johore.			
	4	11	18	25	16	23	7	14	21	28
Smoked Sheet ..	50.00	49.50	50.50	50.50	49.00	49.50	50.91	51.41	51.41	51.41
Unsmoked Sheet ..	43.00	42.50	43.00	43.00	43.00	43.00	45.30	45.30	45.00	45.00
Scrap ..	18.00	17.50	20.00	20.00	16.50	16.50	23.15	23.00	21.75	21.75

Transport from Batu Pahat to Singapore by lorry, excluding duty, $1.00 per picul.

Table II.

Singapore Prices of Various Agricultural Products.

Product	December, 1946			November, 1946	Average Price Jan.-Oct. 1941
	Highest	Lowest	Average	Average	
	per picul $	per picul $	per picul $	per picul $	per picul $
Copra:					
Sundried No. 1 ..	14.00	12.00	13.31	14.00	2.58
No. 2 ..	13.00	12 50	12.70	13.50	2.33
No. 3 ..	12.00	12.00	12.00	*	
Coconut Oil ..	26.00	24.00	24.86	25.90	8.64
Coffee:					
Padang Bali No. 1 ..	100.00	82.00	82.50	71.25	*
No. 2 ..	90.00	31.00	56.67	63.75	*
Palembang No. 1 ..	37.00	30.00	34.32	32.75	18.07-19-91
Sourabaya New No. 1	68.00	60.00	65.00	60.00	19.13-21.02
Bali Old ..	110.00	92.00	97.50	87.50	*
Pepper:					
Muntok White ..	112.00	98.00	100.75	109.00	15.33
Lombong White ..	96.00	82.00	89.00	94.00	*
Sibu White ..	106.00	90.00	97.50	104.00	*
New Black ..	110.00	90.00	101.75	110.00	*
Old ..	108.00	92.00	99.75	108.00	*
Sarawak ..	104.00	104.00	104.00	104.00	*
Siam Black ..	94.00	85.00	92.25	*	*
Nutmeg:					
No. 1 ..	115.00	90.00	100.50	*	25.19
No. 2 ..	92.00	70.00	83.33	*	23.66
Cloves:					
Indian ..	41.00	38.00	39.50	40 00	*
Sumatra ..	65.00	40.00	55.25	62.50	*
Gambier: ..					
Cube No. 1 ..	110.00	90.00	97.50	119.80	13.65
No. 2 ..	100.00	75.00	83.30	98.00	*
Cake ..	110.00	110.00	110.00	*	*
Sago Flour:					
Lingga ..	22.50	20.50	21.25	*	*
Local No. 1 ..	20.50	15.50	18.00	14.38	*
No. 2 ..	17.00	13.50	15.50	11.90	*
Tapioca Flour:					
Malayan No. 1 ..	30.00	21.00	24.00	26.87	*
No. 2 ..	21.00	20 00	20.50	22.25	*
Java ..	33.00	28.00	31.50	32.00	*

* Not quoted.

MALAYAN UNION PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month 1946	Palm Oil	Palm Kernels
May	319.8	—
June	355.9	—
July	502.2	—
August	1,660.0	37.9
September	1,758.7	54.4
October	2,284.7	158.6
November	2,324.8	298.4
December	2,550.3	382.3
Total ..	11,756.4	931.6
Total for the year 1940	57,972.1	9,611.2

Stocks on estates as at 31st December, 1946, were: palm oil 1,656 tons, palm kernels 310 tons.

MALAYAN AGRICULTURAL EXPORTS, SEPTEMBER, 1946.

Product	Net Exports in Tons.		
	Year 1940	September 1941	September 1946
Arecanuts	43,915	119	1,281*
Coconuts fresh†‡ ..	131,469†	10,372†	260*†
Coconut oil‡	69,446	6,245	725
Copra‡	9,004*	3,291*	4,072*
Copra cake	1,215*	119	113*
Gambier, all kinds ..	821	75	130*
Palm kernels	9,219	250	—
Palm Oil	55,990	4,407	889
Pineapples, canned ..	40,243	1,044	22
Rubber¶	547,202¶§	55,402¶§	43,270¶§
Sago,—flour	2,525	1,791	648*
„ —pearl	4,848	547	1
„ —raw	4,816*	409*	133*
Tapioca,—flake ..	762	55	8*
„ —flour ..	2,649*	458*	13
„ —pearl ..	17,004	851	115
Derris	1,254	3,883	46
‡Copra equivalent ..	108,468	7,046	5,245*

† hundreds in number. * net imports. ¶ production.

§ Malayan Union and Singapore.

MALAYAN UNION RUBBER STATISTICS.

Estates of 100 Acres and over. Production and Stocks December, 1946.

In Dry Tons.

STATES	PRODUCTION						STOCKS	
	European	Chinese	Indian	Others	Total December	Total* May to December	Beginning of Month*	End of Month
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Perak ..	4,031	374	221	22	4,648	29,319	3,194	3,521
Selangor ..	4,108	416	109	4	4,637	29,388	4,071	3,923
N. Sembilan ..	2,967	256	96	104	3,423	21,378	2,870	2,468
Pahang ..	782	499	88	—	1,369	10,814	1,204	954
Malacca ..	1,108	414	84	—	1,606	10,213	1,267	1,133
P. Wellesley and Penang	309	79	3	—	391	2,731	333	336
Johore ..	3,193	794	172	415	4,574	29,476	3,502	2,972
Kedah ..	3,127	481	137	34	3,779	22,868	2,368	2,615
Perlis ..	—	3	23	—	26	162	31	31
Kelantan ..	194	22	—	11	227	2,182	269	235
Trengganu ..	31	16	—	—	47	545	90	87
Total ..	19,850	3,354	933	590	24,727	159,076	19,199	18,275

Notes:—1. *Columns 7 and 8 are amended to take into account late returns, and the latest table is, therefore, the most reliable.

2. Production by estates of less than 100 acres for December, 1946 was estimated to be 29,448 tons. Total estimated small-holding production May to December, 1946, 179,708. tons.

3. Stocks on estates of less than 100 acres are not ascertained.

4. The above forms part of the December rubber statistics published by the Registrar of Statistics, Malayan Union, at Kuala Lumpur on 21st January, 1947.

MALAYAN UNION RUBBER STATISTICS.

Summary of Stocks, Production, Imports and Exports of Rubber, December, 1946.

In Long Tons, Dry Weight.

		Tons	Tons
STOCKS (30th November)			
Estates (amended)	..	19,199	
Dealers	..	50,357	
Ports, awaiting shipment	..	17,115	86,671
IMPORTS	..		4,629
PRODUCTION			
Estates	..	24,727	
Small-holdings (estimated)	..	29,448	54,175
			145,475

		Tons	Tons
EXPORTS			
Foreign	..	36,869	
Local (to Singapore)	..	16,856	53,725
LOCAL CONSUMPTION	..		1,323
STOCKS (31st December)			
Estates	..	18,275	
Dealers	..	62,958	
Ports, awaiting shipment	..	9,194	90,427
			145,475

Note:—The above forms part of the December rubber statistics published by the Registrar of Statistics, Malayan Union, at Kuala Lumpur, on 21st January, 1947.

MALAYAN UNION

PADI SEASON 1946—1947.

Acreages of Wet Padi Planted monthly during 1946 and Percentages of Total Planted Area.

STATE (1)	September (2)		October (3)		November (4)		December (5)		Total (6)		Total Area Planted and to be Planted (7)	Per cent (8)
	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)		
Perlis ..	29,470	80.5	4,260	11.5	2,700	8.0	210	—	36,640	100.0	36,640	5.0
Kedah ..	116,660	49.0	64,960	27.0	47,110	20.0	8,090	3.0	236,820	100.0	236,820	32.0
Kelantan ..	30,675	23.5	4,838	3.5	49,048	37.0	9,928	7.0	132,814	98.0	135,014	18.0
Trengganu ..	—	—	14,346	40.0	12,722	37.0	7,703	22.0	34,771	100.0	34,794	5.0
Penang & P. Wellesley	4,406	12.0	18,570	51.0	12,366	34.0	1,252	3.0	36,594	100.0	36,594	5.0
Perak ..	41,942	40.0	18,812	18.0	24,372	23.0	19,992	19.0	105,118	98.0	106,964	14.0
Selangor ..	3,937	11.0	7,871	22.0	2,467	7.0	5,662	16.0	19,937	55.0	36,092	5.0
Pahang ..	2,566	6.0	1,087	2.5	1,065	2.5	542	1.0	39,639	97.0	40,827	6.0
N. Sembilan ..	2,420	8.0	474	1.5	87	—	49	—	29,612	96.0	30,987	4.0
Malacca ..	10,536	35.0	3,723	12.0	327	1.0	272	—	30,611	100.0	30,611	4.0
Johore ..	9,043	66.0	1,799	13.0	915	6.0	443	3.0	12,200	86.0	14,042	2.0
	251,655	34.0	140,740	19.0	153,179	21.0	54,053	7.0	714,756	97.0	739,385	100.0

Compiled by the Registrar of Statistics, Malayan Union, from returns received through the Field Branch of the Department of Agriculture.

	JULY. Acres	AUGUST. Acres
Kelantan ..	—	38,325
Pahang ..	23,429	11,040
N. Sembilan ..	23,356	3,226
Malacca ..	10,713	5,040
	57,498	57,631

MALAYAN UNION

PADI SEASON 1946—1947.

Total Acreages of Wet and Dry Padi Planted and to be Planted.

STATE	WET PADI		DRY PADI Total Planted and to be Planted	TOTAL Wet and Dry Padi Area Planted and to be Planted.
	Planted by 31st December, 1946 Acres	Total Planted and to be Planted Acres	Acres	Acres
Perlis ..	36,640	36,640	60	36,700
Kedah ..	236,820	236,820	4,390	241,210
Kelantan ..	132,814	135,014	29,893	164,907
Trengganu ..	34,771	34,794	18,182	52,976
Penang & P. Wellesley ..	36,594	36,594	840	37,434
Perak ..	105,118	106,964	13,371	120,335
Selangor ..	19,937	36,092	4,614	40,706
Pahang ..	39,639	40,827	2,334	43,161
Negri Sembilan ..	29,612	30,987	40	31,027
Malacca ..	30,611	30,611	130	30,741
Johore ..	12,200	14,042	4,456	18,498
Totals ..	714,756	739,365	78,310	817,695

Compiled by the Registrar of Statistics, Malayan Union, from returns received through the Field Branch of the Department of Agriculture.

Estimated Total Yield 1946—1947 = 275,000 tons of rice.

1940—1941 Wet Padi ..	742,600 acres.		1945—1946 Wet Padi ..	684,005 acres.	
Dry „ ..	77,880 „		Dry „ ..	105,635 „	
Total ..	820,480 „		Total ..	789,640 „	
Total Yield 324,211 tons of rice.			Total Yield 225,044 tons of rice.		

METEOROLOGICAL SUMMARY, MALAYA, NOVEMBER, 1946.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes,									Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min	At 1 foot	At 4 feet	Total.		Most in a day. Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
Ipoh, Perak ...	91-3	72-5	81-9	95	71	85	75			10-12	257-0	1-58	22	18	2					
Port Swettenham, Selangor	88-9	72-8	80-9	93	71	84	74	84-7	85-0	9-43	239-5	1-42	18	18						
Sitiawan, Perak ...	87-6	73-3	80-5	90	72	83	75			12-03	305-6	1-66	23	22	5	3				
Kuala Lipis, Pahang ...	86-6	72-4	79-5	91	71	78	74	83-3		4-09	103-9	0-62	22	17	2	26				
Kuantan, Pahang ...	86-8	73-3	80-0	91	71	78	75			19-31	490-5	6-61	19	19		1				
Bayan Lepas, Penang ..	87-2	74-4	80-8	90	73	83	77			11-99	304-5	3-81	26	21	9					
Malacca ...	85-8	74-1	79-9	91	72	83	76			7-90	200-7	1-86	23	18	2					
Mersing, Johore ...	85-2	72-9	79-1	92	71	78	74			10-27	260-9	2-94	24	20						
Alor Star, Kedah ...	88-5	73-2	80-9	92	71	79	75			6-47	164-3	1-54	21	19	5	16				
Kuala Trengganu, Trengganu	84-8	73-0	78-9	89	72	75	75			27-69	703-3	3-68	27	27	2		3			
HILL STATIONS. Fraser's Hill, Pahang 4268 ft.	71-0	62-2	66-6	76	60	65	64	70-2		9-62	244-3	1-80	21	18	1	19	1			
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72-5	57-7	65-1	76	53	67	64	69-6		11-57	293-9	1-86	23	22	2	1				

Compiled from Returns supplied by the Meteorological Branch, Malaya.